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United States Department of Agriculture, DIVISION OF BOTANY.

OBSERVATIONS ON CASES OF MUSHROOM POISONING IN THE DISTRICT OF COLUMBIA.

The death, in the city of Washington, on November 10, 1897, of Count Achilles de Vecchj, and on October 17, 1894, of an educated Chinaman named Chung Yu Ting, both from eating poisonous mushrooms, which they had themselves mistaken for edible ones, seems to require a public warning. Many kinds of fleshy fungi are without question delicious and wholesome foods, while the gathering of them is an exhilarating pastime. A novice who proposes to gather mushrooms for himself should never use a species for food until he has found out positively its name and its nonpoisonous character.



FIG. 1.—Common mushroom, *Agaricus campestris*.^{*} Edible. Three-fourths natural size.

He should then familiarize himself with this species until he knows it from all others as certainly as he knows the cabbage, the turnip, the cauliflower, or any other of our common vegetables. He should confine himself rigidly to this his personal edible list, and should add to it only as thus recommended. His authority for the name and qualities of each kind he adds to this list should be some person having an unquestioned expert knowledge of mushrooms. There is no

^{*}The technical or Latin names of the fungi mentioned in this circular are those in current use among botanists, no attempt having been made to ascertain whether these are really their oldest generic and specific designations.

single test and no safe series of tests for poisonous mushrooms. The poisons contained in the various species are extremely diverse in their physiological effects and their chemical composition. In the District of Columbia occur at least thirty good-sized edible species, at least four species known to be poisonous, and several more that are suspected of being poisonous. Regarding these suspected species, we shall never know the actual facts until some one has been poisoned by them or until experiments are made on animals to ascertain their physiological effects. Botanists, who from long training in the discrimination of plants possess the faculty of distinguishing readily between related species, will easily avoid the error of mistaking superficial resemblances for the real characteristics of the different kinds, and may be trusted in the identification of mushrooms, if they have studied that group of plants. If there is a mushroom club in the community, every one who proposes to become a connoisseur in



FIG. 2.—Horse mushroom, *Agaricus arvensis*. Edible. One-half natural size.

mushrooms should join it. In the District of Columbia is an association, recently organized, known as the Washington Mycological Club; in Boston there is the Boston Mycological Club; and in Philadelphia, the Philadelphia Mycological Center. Membership in such an organization and a proper use of the facilities afforded by it should prevent the mistaking of a poisonous for an edible species.

For those who purchase their mushrooms instead of gathering them for themselves, the judgment of the colored market women in Washington that a particular species is edible I consider as safe a guide as the decision of the highest botanical authority, not because their knowledge of mushrooms is extensive but because they are thoroughly familiar with the two or three edible species they handle and know them as certainly from poisonous kinds as they know per-

simmons from crab apples or opossums from rabbits. The colored women shun all other kinds of fungi, whether poisonous or not, with a half-superstitious dread. This statement is made because the impression has been created that the poisonous mushrooms connected with the recent fatal case were on public sale in the K street market. They were not on sale, but were brought in from Virginia by a countryman who was delivering them, somewhat under protest, upon the order of the gentleman whose death they afterwards caused. The gentleman had requested samples of a fungus that the countryman described as growing near his farm and, after examining the samples, had pronounced them edible and ordered a basketful.

In the Washington markets four kinds of edible fungi may be found on sale in abundance on almost any market day during the autumn months, and to a more limited extent at times favorable to their growth during the spring and summer. These are the

common mushroom (*Agaricus campestris*); the horse mushroom (*Agaricus arvensis*); the shaggy mushroom (*Coprinus comatus*), incorrectly called French mushroom by the market women; and the puffball (*Lycoperdon cyathiforme*).

A few of the numerous other edible species of the vicinity are brought now and then to market, usually to fill some particular order, but as they do not sell readily on the open market and the people who bring them are half doubtful of their qualities, little progress has been made toward popularizing them.

In the belief that good photo-mechanical reproductions from characteristic photographs of a few common and easily distinguished species, accompanied by explanatory text, will be of some service to the public as a preventive of fatal mistakes, the present brief paper has been prepared. While these notes are issued primarily for use in the District of Columbia, the information they contain is of much wider application, for the species described occur over nearly all except the arid portions of the United States. The photographs were made principally by Mr. A. J. Pieters of the Division of Botany.



FIG. 3.—Horse mushroom, *Agaricus arvensis*, button. Edible. Three-fourths natural size.



FIG. 4.—Horse mushroom, *Agaricus arvensis*, button. Edible. Three-fourths natural size.

COMMON MUSHROOM (EDIBLE).

Agaricus campestris L.

Fig. 1 represents the common mushroom. The second specimen from the left is a young one, not yet expanded, commonly called a button. The specimen at the extreme left is a somewhat larger button viewed from the top, showing the slightly checked surface that sometime occurs in this species. Typically in fresh specimens the surface is white, but various shades of light brown, either plain or checked, are often found. The specimen at the right is slightly expanded and, like the largest fully expanded specimen at its left, shows the gills on the lower surface of the cap. These gills in a newly expanded mushroom fresh from the field are of a beautiful and delicate pale pink color, often with a tinge of salmon. As in all the gill-bearing fungi mentioned in this paper, the gills end toward the center with an abrupt upward curve without being attached to the stem as in some other kinds of mushrooms.

As they grow older, especially after they are picked, the gill turns in a few hours to a light brown and finally to a dark chestnut-brown, almost black, color. This discoloration is



FIG. 5.—Horse mushroom, *Agaricus arvensis*, button just opening. Edible. Three-fourths natural size.

chiefly due to the maturity of innumerable minute bodies called spores, which are developed on the edge and on the faces of each of the gills. If the stem of a common mushroom be broken off and the cap be laid gills downward on a piece of white paper the spores will drop off and after a few hours will appear as a brown dust on the surface of the paper, lying in radiating lines that indicate the position of the gills. In each of the two right-hand specimens there appears at about the middle of the stem a ring that marks the line of junction between the stem and the margin of the cap before the latter was expanded. In the smaller button this line of junction may still be seen unbroken. The usual diameter of fully expanded specimens of the common mushroom is one and a half to three inches, though smaller and larger specimens are frequently found.

The common mushroom is the principal mushroom of the markets. In the months of September, October, and November, when the autumn rains have succeeded the usual dry period of summer and the continued cold weather of winter has not yet set in, the chief harvest of this mushroom occurs. In the vicinity of Washington

the most abundant crops come, in normal years, in October, when soaking rains are accompanied by warm nights. During the spring and summer there has been developing underneath the surface of the ground a mass of white, root-like, loosely interwoven threads and strands, which are known to botanists as the mycelium of the



FIG. 6.—Shaggy mushroom, *Coprinus comatus*. Edible. Three-fourths natural size.

mushroom. Popularly this is known as the mushroom spawn, more especially when in its impure, dried, commercial form, pressed into bricks or flakes for the artificial propagation of mushrooms.

Without the autumn rains the little pill-like bodies that form upon the mycelium are unable to absorb sufficient moisture to continue their development into buttons; but, when this moisture is supplied,

only a few days, commonly three or four, pass before the mushrooms appear above the ground. It usually requires only a single night for a button to push through the surface of the soil and expand its cap. When one day old a mushroom is usually still edible, but insect larvæ soon attack it, traveling up through the stem into the cap, and decomposition rapidly follows. A quick way to find out whether a specimen of the common mushroom is wormy is to break off its stem close beneath the cap. If the larvæ have passed through, the little holes left by them are readily seen.

About Washington the common mushroom occurs oftenest on lawns and in pastures, and especially in neglected fields where weeds have been succeeded by a scant covering of grass. Such areas are here known in a somewhat specific sense as "old fields." Probably the most prolific of these old fields in mushrooms is the one at Chevy



FIG. 7.—Puffball, *Lycoperdon cyathiforme*, side view. Edible. Three-fourths natural size.

Chase, lying between Chevy Chase circle and the Tenleytown car line. It is marked especially by a low hill near its center, bearing a small but conspicuous grove of young trees. On suitable mornings in October a dozen mushroom gatherers are frequently on hand at sunrise in this field to get a choice selection of the night's product. Another locality where this mushroom is abundant is the

field outside the Soldiers' Home grounds, at the south gate.

Occasionally in spring or summer small quantities of the common mushroom are brought into market. These have usually been gathered upon various dumping grounds of the city, where rubbish of all kinds except garbage is deposited. These situations seem to furnish the conditions necessary for an early development of the mushroom from the mycelium.

In late autumn and winter large quantities of cultivated mushrooms belonging to the same species as the common mushroom appear in the market. These are grown sometimes in greenhouses, sometimes in cellars, and are handled in the regular market stalls—not by farmers or colored women. Most of those sold in Washington come from New York, New Jersey, and Delaware. The price commonly ranges from 75 cents to \$1 per pound, but in the fall it

often drops to 25 cents and in winter rises sometimes to \$1.50. The price of the native product is commonly 20 cents per quart basket (weighing a scant pound), but it sometimes is a little higher, and it often on an overstocked fall market goes down to 10 cents a quart.

The ordinary methods of cooking the common mushroom are frying in butter, broiling and serving on toast, stewing in gravy and serving with beefsteak, and simply stewing in milk. Detailed recipes for these and other methods of cooking may be found in any good cookbook. As a preliminary to cooking, the lower end of the stem is cut off and the thin skin on the upper surface of the cap is usually peeled off in strips from margin to center. If this surface is clean and white, however, peeling is not necessary.

THE HORSE MUSHROOM (EDIBLE):

Agaricus arvensis Schaeffer.

Fig. 2 represents three moderately expanded specimens of the horse mushroom. At a later stage they expand quite as fully as the large specimen in fig. 1. It should be noted that, while this species agrees in most details with the preceding, the surface of the cap is darker-colored than in *campestris*, though specimens of a considerably lighter shade of brown are often found; that it is larger; and that the ring is wider and thicker than in the other. Usually the ring is distinctly marked on its upper surface by a series of lines where



FIG. 8.—Puffball, *Lycoperdon cyathiforme*, top view. Edible. Three-fourths natural size.

the edges of the gills before expansion have pressed against it. The difference in size between the two species (the cap in *arvensis* is commonly 3 to 6 inches broad) is not well brought out by this figure, for it is only one-half natural size, while the figure of *campestris* is three-fourths natural size. Figs. 3 to 5 represent some buttons of the horse mushroom in various stages of development.

The horse mushroom is not always distinguished from the common mushroom by the market people, and indeed in its technical characteristics it is closely related to that species. It is often sent to the

Department for identification, however, as something different from the common mushroom, and it presents sufficient differences to be always recognizable by one familiar with mushrooms. Its characteristic place of growth about Washington is not in fields but in gardens, especially very rich or heavily fertilized ones, where it often occurs in cold frames or around hot beds.

On account of its large size this mushroom is better adapted than others for broiling or frying.

THE SHAGGY MUSHROOM (EDIBLE).

Coprinus comatus Pers.

Fig. 6 represents a bunch of three specimens of the shaggy mushroom, showing as many stages in the development of this species. In the middle is an old specimen in which liquefaction has progressed so far that the lower part of the cap has already disappeared. Not



FIG. 9.—Puffball, *Lycoperdon cyathiforme*, viewed diagonally from above. One-half natural size. Not edible in this stage.

only are the spores of this species black, but the whole plant, beginning at the outer edge of the cap, dissolves when the mushroom is about a day old into an inky-black fluid. Some of this inky fluid has dropped from the large specimen upon the small one at the left and has run down its stem. At the right is a specimen showing the characteristic appearance of the cap which, except in its latest stages, has somewhat the form of a closed umbrella. In their early stages the cap, gills, and stem are white, excepting frequently the apex of the cap, which is often dark-colored as in the figure. This is due to contact with the soil before the mushroom pushed out of the ground, by which the apex is stained brown. The surface of the cap is covered with delicate lacerated scales, a characteristic from which the name of the species, *comatus*, or shaggy, was derived. The ring is only very loosely attached, either to the stem or to the margin of the cap, and sometimes is wholly free from both, early dropping down

to the base of the stem. In the right-hand specimen of the figure the first stage of discoloration has begun. In the white part of the cap the juice is as colorless as water; toward the margin it is wine-colored. In this stage the shaggy mushroom is still in condition to be eaten, but when the juice turns black the mushroom is usually considered too old for the table. By some persons, however, it is still eaten, chiefly in the form of a catchup, when it is black and partially dissolved, as in the largest specimen in fig. 6.

Unlike the last two species, this mushroom has as its favorite place of growth, not fields and pastures, but shaded situations, where the ground is rich or well supplied with thoroughly decomposed wood or other vegetable matter. It occurs, for example, abundantly under the trees or on the margins of the White Lot and in the Smithsonian grounds. It grows in greatest abundance in the low grounds near the Potomac, shaded by willows or rank weeds, particularly near the foot of Seventeenth street. The season of greatest abundance is the late autumn, in November and early December, when the nights are usually cold but the ground is not yet frozen.

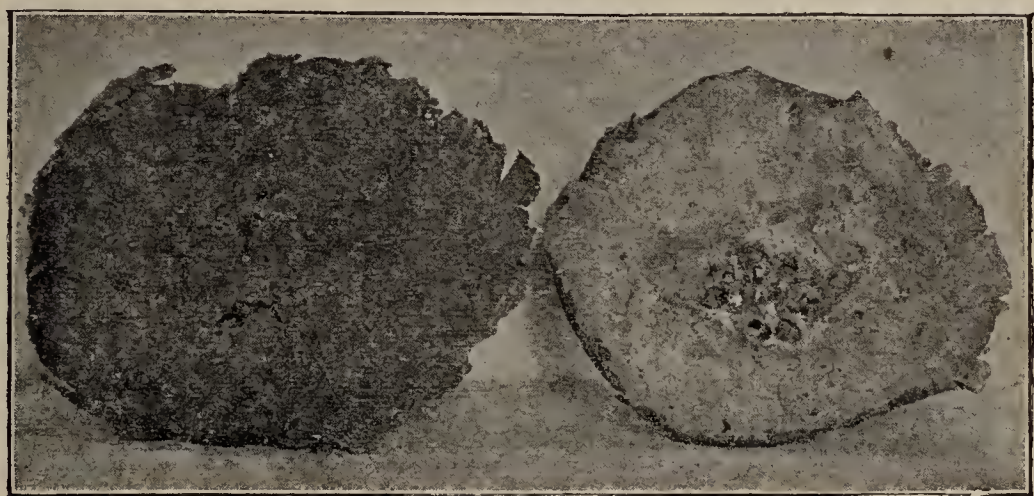


FIG. 10.—Puffball, *Lycoperdon cyathiforme*, viewed diagonally from above.
Not edible in this stage. One-half natural size.

The shaggy mushroom should be cooked before its margin turns black, preferably while it is yet white throughout, certainly not later than the stage of the wine-colored juice. Liquefaction sets in so early that seldom does the mushroom have time to become infested with larvæ. A certain myriapod, or thousand-legged worm, however, often works his way into the space between the gills and the stem, where he lies snugly feeding on the tender gills. This cavity should always be examined when the mushroom is being cleaned. The worm is, however, nonpoisonous.

Ordinarily this species is cooked by stewing or frying, but sometimes, when older, it is made into a black catchup.

THE PUFFBALL (EDIBLE).

Lycoperdon cyathiforme Bosc.

Fig. 7 is a side view of a young and solid puffball which has been removed from the ground. Fig. 8 is a top view of the same specimen. A description of so simple an object is difficult. The exterior color is brown, and the outermost part of the covering is usually more or less distinctly and irregularly checked, the white color of the interior showing between the darker, raised areas. Within at its earliest stage the flesh is of a milk-white color, solid, and without an appreciable juice. Within two or three days it becomes soft, turns yellowish, develops a watery and later an amber-colored juice, and continues its development through later stages. In the left-hand specimen of fig. 9 the entire contents have changed

FIG. 11.—Two fairy rings formed by *Marasmius oreades*.

from yellow to brown, the juice has dried out, the outer coatings on the upper part have been broken up and blown away, showing only in brown and gray at the lower edge of the specimen, and the interior mass of dustlike spores and fluffy minute brown threads is exposed to the air. In the right-hand specimen the process has gone a step further and a large part of the contents of the puffball have been blown away by the wind. From the character of the fungus at this stage has arisen a name by which it is familiarly known among the colored people in the vicinity of Washington, “the devil’s snuff box.” Fig. 10 shows further stages in the plant’s history. In the right-hand specimen is shown the final form of the plant. It is dry and leathery, the spores all blown away, and the slender threads beaten down by the rain and dried together on the surface into a

smooth skin. The specimen is tilted forward, but viewed directly from the side it would present roughly the form of a broad urn. This is the characteristic form of an old puffball of this species. In none of the stages shown in figs. 9 and 10 is the puffball edible. It is too dry and leathery.

Other species of puffball grow in the District of Columbia, but only two others, so far as known, approach this in size. The small species are commonly an inch or less in diameter, while the commoner of the two large species has an almost pure white surface, and when old the spores it produces, like those of the other large one, are yellowish-brown instead of purplish-brown as in the present species. None of the puffballs with a pure white interior are known to be poisonous.



FIG. 12.—Fairy ring formed by *Marasmius oreades*, an edible mushroom.

About Washington puffballs are found commonly in the autumn on lawns and in pastures, especially upon the vacant lots in the edge of the city serving as “commons,” where the soil has remained undisturbed for many years and has been closely grazed by cattle. If one examines with some care such an area on which puffballs are growing he will find that adjacent puffballs are usually arranged at irregular intervals along a circular line and that the greater part of the circle, sometimes the entire circle, is marked by a band of grass slightly darker in color than that on either side. These circles are commonly four to eight feet in diameter and sometimes much larger.

One has been measured that was 24 feet across. The band of dark-green grass is usually about a foot in breadth. These circles, which are known as "fairy rings," are more conspicuously developed in the next species, where their structure is described more in detail.

It is only while the interior is still solid and white, with the texture of cheese, that the puffball is edible. After a few days, when this mass begins to soften, it turns slightly yellowish and a juice can be squeezed out by the hand. At this stage the puffball is indigestible and has been known to produce severe nausea.



FIG. 13.—Fairy-ring mushroom, *Marasmius oreades*, moderately expanded. Edible. Three-fourths natural size.

As a preparation for cooking the young solid puffball is first peeled, the tender brown-coated skin being perhaps a sixteenth of an inch in thickness, and the white interior is cut into slices about an eighth to a quarter of an inch in thickness. These slices are fried in butter without further preparation. The puffball, though it has not so pronounced a flavor as the common mushroom, has been used also with great success in stews, in omelets, and in the stuffing of roast fowls. For these purposes the peeled puffball is simply crumbled in the hand before cooking. The fact that a neatly peeled puffball is entirely free from sand or dirt further recommends it as a substitute for mushrooms.

THE FAIRY-RING MUSHROOM (EDIBLE).

Marasmius oreades (Bolt.) Fr.

Fig. 11 is a picture taken in November on the grounds of the Department of Agriculture looking northwestward from the vicinity of the mulberry group. The two fairy-rings are at the stage after the mushrooms have ceased to develop, when the rings are marked only by a vigorous growth of dark-green grass about a foot in breadth. Both these rings are broken toward the right. The larger one, at the left, measures this year about 18 feet in diameter; the other one about 13 feet. Fig. 12 is a picture of another fairy-ring, about 7 feet in diameter, taken early in November on the same grounds, at the time when it bore its full fall crop of mushrooms. Figs. 13



FIG. 14.—Fairy-ring mushroom, *Marasmius oreades*. Edible. Three-fourths natural size.

to 17 show the mushrooms, three-fourths natural size, in various stages of development. It will be noted that the stem, unlike all the

other mushrooms described, has no ring; that the gills are comparatively few and far apart; and that the cap, as it becomes widely expanded, has a peculiar knob-like projection in the center. This gives to the fairy-ring mushroom a characteristic appearance. The cap and stem have a pinkish-buff color, and the gills a lighter shade of the same, varying in its younger stages toward a cream color. The spores are white, and in ascertaining their color the cap should be laid on some dark-colored, preferably black, paper.

The fairy-ring mushroom is one of the commonest species on the lawns of the city of Washington, yet so little attention is paid to the study of mushrooms that seldom does one meet a person who knows that such a thing as a fairy-ring exists. The grounds of the



FIG. 15.—Fairy-ring mushroom, *Marasmius oreades*, viewed diagonally from beneath. Edible. Three-fourths natural size.

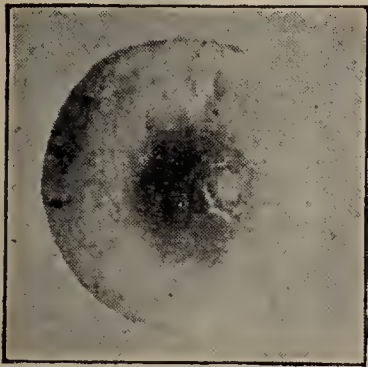


FIG. 16.—Fairy-ring mushroom, *Marasmius oreades*, top view. Edible. Three-fourths natural size.

Department of Agriculture contain scores of them, and the grounds of the Dean property, for example, near the head of Connecticut avenue, have some very perfect ones. In general they can be found in any old and well-kept lawn.

In the days of early superstition in Europe these rings were supposed to mark the place of fairy dances, and thus they were called fairy-rings. With the springing up of the modern tendency toward scientific investigation, however, the assigning of a reasonable cause for this curious phenomenon was demanded, and among

the first attempts was one explanation that was very ingenious. According to this theory the ring marked the spot where a lightning stroke had descended into the earth. It was assumed that the lightning bolt was of the same diameter as the ring and that only where the lightning bolt came in contact with the air, namely, along its surface, did combustion take place. Therefore as the bolt descended into the ground it burned a ring of grass, and this dead vegetable matter acting in following years as a fertilizer stimulated the new grass to a dark green growth. So great indeed



FIG. 17.—Fairy-ring mushroom, *Marasmius oreades*, the larger specimen widely expanded. Edible. Three-fourths natural size.

was the fertilizing effect that a certain kind of mushroom very often grew along the dark green band.

The lightning theory was soon dispelled, however, by a more accurate knowledge of the life history of fungi. It is now known that the ring is due to the uniform annual growth of the mycelium. This starting at a central point grows each year a few inches outward, the older portion beginning to die at the center. Thus a small circular band is formed and each year this increases in size, growing regularly on the outside and dying as regularly on the inside. The mycelium in some manner not yet fully understood exerts a stimulus on the grass among the roots of which it is interlaced, and a more vigorous and darker green growth is the result.



FIG. 18.—Fly amanita, *Amanita muscaria*. Poisonous. One-half natural size.

The fairy rings, except when young, seldom form complete circles, usually appearing as broken rings or crescents. The opening when the ring is on a slope is almost invariably on the down-hill side.

Several crops of mushrooms are produced on a single ring during a season, the most abundant crop coming after the autumn rains. If a dry period follows their appearance, the mushrooms dry and are preserved as long as the drought lasts. They decompose only after repeated wetting and drying, are almost wholly free from the attacks of insects, and are usually quite free from dirt, except after a hard rain.

For cooking they require no preparation except the cutting off of the lower part of the stem. They have a pronounced flavor and should be brought on the table in the form of a stew. They are too small to be fried or broiled.

THE FLY AMANITA (POISONOUS).

Amanita muscaria (L.) Pers.

Fig. 18 shows a fully developed specimen of the fly amanita, the commonest of the poisonous mushrooms of the District of Columbia. Fig. 19 shows another specimen in a different position, and fig. 20 a top view of its cap. The points especially to be noted are the bulbous enlargement at the base of the stem, breaking into thick scales above, the very broad drooping ring near the top of the stem, and



FIG. 19.—Fly amanita, *Amanita muscaria*. Poisonous. One-half natural size.

the corky particles loosely attached to the smooth, glossy upper surface of the cap. The stem, the gills, and the spores are white, the corky particles commonly of a buff color, but varying, sometimes to almost white. The glossy upper surface of the cap, beneath the corky particles, varies from a brilliant red to orange yellow, buff, and even white. Commonly in the vicinity of Washington the

coloration is orange in the center, shading to yellow toward the margin. Brilliant red ones are rarely seen here, but white ones are of not infrequent occurrence, especially late in the season. It sometimes happens that the corky layer does not break up into particles, but simply stretches as the cap expands. Such a specimen, if it is of a pale buff or white color, would not be taken by a novice as belonging to the same species as the brilliant orange or red specimens, and a mistake might easily be made. Often, too, the bulbous scaly base is broken off in picking and even that characteristic is lost. Therefore, if there is the slightest doubt about specimens

which it is proposed to eat, ask an expert.



FIG. 20.—Fly amanita, *Amanita muscaria*, top view. Poisonous. † Two-fifths natural size.

Fig. 21 shows two young specimens, still in the button stage, the corky outer covering of the undeveloped cap just breaking up into particles. Fig. 22 shows the ring still attached in part to the margin of the cap. Fig. 23 is another specimen in which the ring in breaking away has remained attached to the margin of the cap instead of the stem. In such cases the ring becomes broken into fragments

which are usually soon blown away, leaving only a mark upon the stem to show the ordinary position of the ring. In fig. 24 is seen a ring almost wholly broken away from the cap. This is a fair sample of the ordinarily somewhat torn appearance of the ring in this species. This figure, together with fig. 18, shows another feature usually present in the fly amanita, namely, the striations on the upper side of the cap near the margin.

The fly amanita is one of the largest, handsomest, and most dangerous of our mushrooms, and is the one whose character has been the most fully studied of all the poisonous species. It is abundant about Washington in the fall, growing in pine woods, a favorite situation in these woods being the vicinity of abandoned hog beds. The specimens that caused the death of Count de Vecchj came from a pine wood about a mile west of Fort Myer, between Balls Crossroads and Columbia Pike. It was from one of those left uncooked from this lot that the photograph reproduced in fig. 24 was taken.

The specimen had been lying on its side for a few hours and the cap had assumed a horizontal position.

The chief active poisonous principle of the fly amanita is an alkaloid called muscarine, but other poisonous substances, the chemical nature of which is not yet fully known, also occur in the plant. The symptoms and treatment are thus described by Mr. V. K. Chesnut, assistant in charge of investigations of poisonous plants:

The symptoms of poisoning from the fly amanita, as deduced from a number of cases, are varied. In some instances they begin only after several hours, but usually in from one-half to one or two hours. Vomiting and diarrhea almost

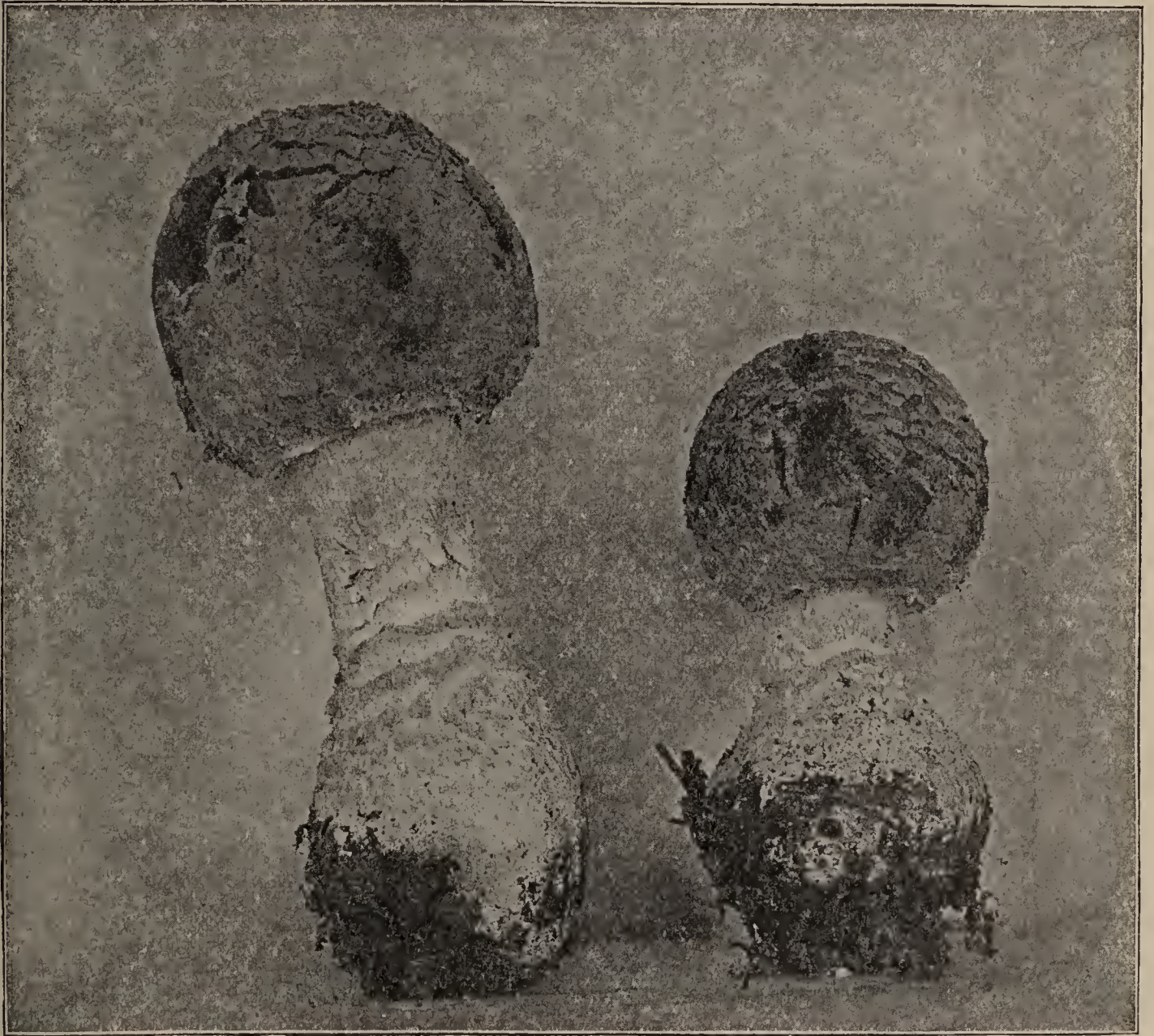


FIG. 21.—Fly amanita, *Amanita muscaria*, buttons. Poisonous. Natural size.

always occur, with a pronounced flow of saliva, suppression of the urine, and various cerebral phenomena beginning with giddiness, loss of confidence in one's ability to make ordinary movements, and derangement of vision. This is succeeded by stupor, cold sweats, and a very marked weakening of the heart's action. In case of rapid recovery the stupor is short and usually marked with mild delirium. In fatal cases the stupor continues from one to two or three days and death at last ensues from the gradual weakening and final stoppage of the heart's action.

The treatment for poisoning by *Amanita muscaria* consists primarily in removing the unabsorbed portion of the amanita from the alimentary canal and in counteracting the effect of muscarine on the heart. The action of this organ should be fortified at once by the subcutaneous injection, by a physician, of atropine in doses of from one one-hundredth to one-fiftieth of a grain. As a stimulant emetic, mustard is particularly valuable. If this is not effective, apomorphine should be administered by a physician. In case of profound stupor, however, even this may not produce the desired action. Tannin is of little or no value in rendering the muscarine insoluble in the stomach. If vomiting has not taken place, recently burned charcoal or two grains of a one per cent alkaline solution of permanganate of potash may then be administered, in order, in the case of the former substance, to absorb the poison, or, in case of the latter, to decompose it. This should be followed by oils and oleaginous purgatives, and the intestines should be cleaned and washed with an enema of warm water and turpentine.



FIG. 22.—Fly amanita, *Amanita muscaria*, partly expanded. Poisonous. Three-fourths natural size.

Experiments on animals poisoned by the fly amanita and with pure muscarine show very clearly that when the heart has nearly ceased to beat it may be stimulated to strong action almost instantly by the use of atropine. Its use as thus demonstrated has been the means of saving many lives. We have in this alkaloid an almost perfect physiological antidote for muscarine, and therefore in such cases of poisoning its use should be pushed as heroically as the symptoms will warrant. The presence of phallin in *Amanita muscaria* is possible, and its symptoms should be looked for in the red color of the blood serum discharged from the intestines. Its treatment, which is difficult, is discussed under *Amanita phalloides*.

It is well known that in some parts of Europe the fly amanita, after the removal of the poison by treatment with vinegar, is a common article of food. It was interesting to discover not long since that among some of our own people a similar practice prevails. Though most of the colored women of the markets look upon the species with horror, one of them recited in detail how she was in the habit of cooking it. She prepared the stem by scraping, the cap by removing the gills and peeling the upper surface. Thus dressed the mushrooms were first boiled in salt and water, and afterwards steeped in vinegar. They were then washed in clear water, cooked in gravy like ordinary mushrooms, and served with beefsteak. This is an exceedingly interesting operation from the fact that although its author was wholly ignorant of the chemistry of mushroom poisons, she had nevertheless been employing a process for the removal of these poisons which was scientifically correct.

The gills, according to various pharmacological researches, are the chief seat of the poisonous principles in this plant and their removal at once takes away a large part of the poison. The salt and water would remove phallin or any other toxalbumin the mushroom

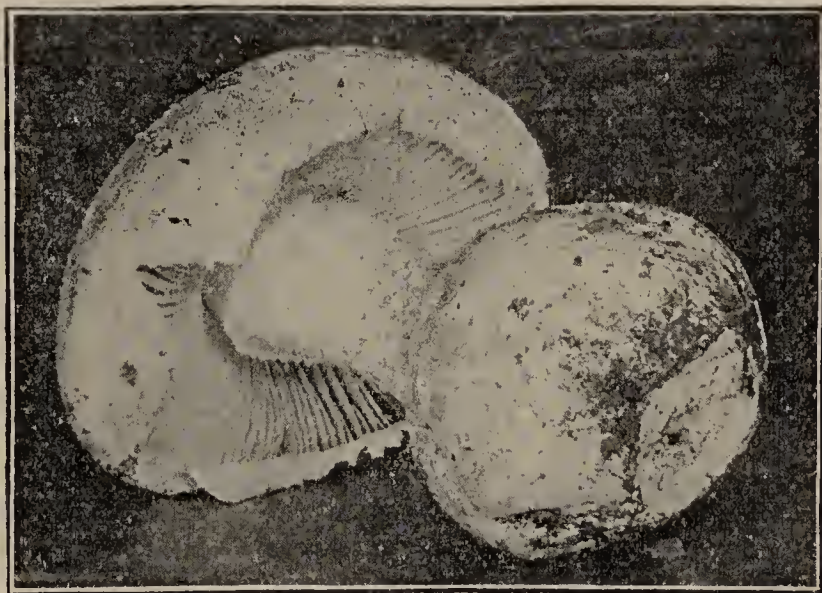


FIG. 23.—Fly amanita, *Amanita muscaria*, partly expanded. Poisonous. Three-fourths natural size.

contained, and although the presence of phallin or any of this class of poisons has not been demonstrated in *Amanita muscaria*, there is a strong suspicion that it may occur in slight amount. The vinegar, secondly, removes the alkaloid poison, muscarine, and the mushroom after the two treatments is free from poisons. This process is cited, not to recommend its wider use, but as a matter of general interest. The writer's recommendation is that a mushroom containing such a deadly poison should not be used for food in any form, particularly at a season when excellent non-poisonous species may be had in abundance.

It is surprising that cases of poisoning are not more frequent. At Takoma Park, D. C., on November 9, of last year, a lady who has a thorough knowledge of edible and poisonous mushrooms met a family, consisting of a man, woman, and two children, who had just completed the gathering of a basketful of the fly amanita and the death cup, described below, which they were taking home to eat.

In reply to questions the woman stated that they had often eaten this kind purchased dry at an Italian store, but that they had never gathered fresh ones before. Of course they had mistaken the species, or possibly the dried ones were fly amanitas from which the poison had been removed by treatment with vinegar. After considerable persuasion the people consented to throw the lot away.

It is impossible to say what amount of the fly amanita would prove fatal, but in this connection it is of interest to note the custom reported by Krasheninnikoff, a Russian who traveled in Siberia and

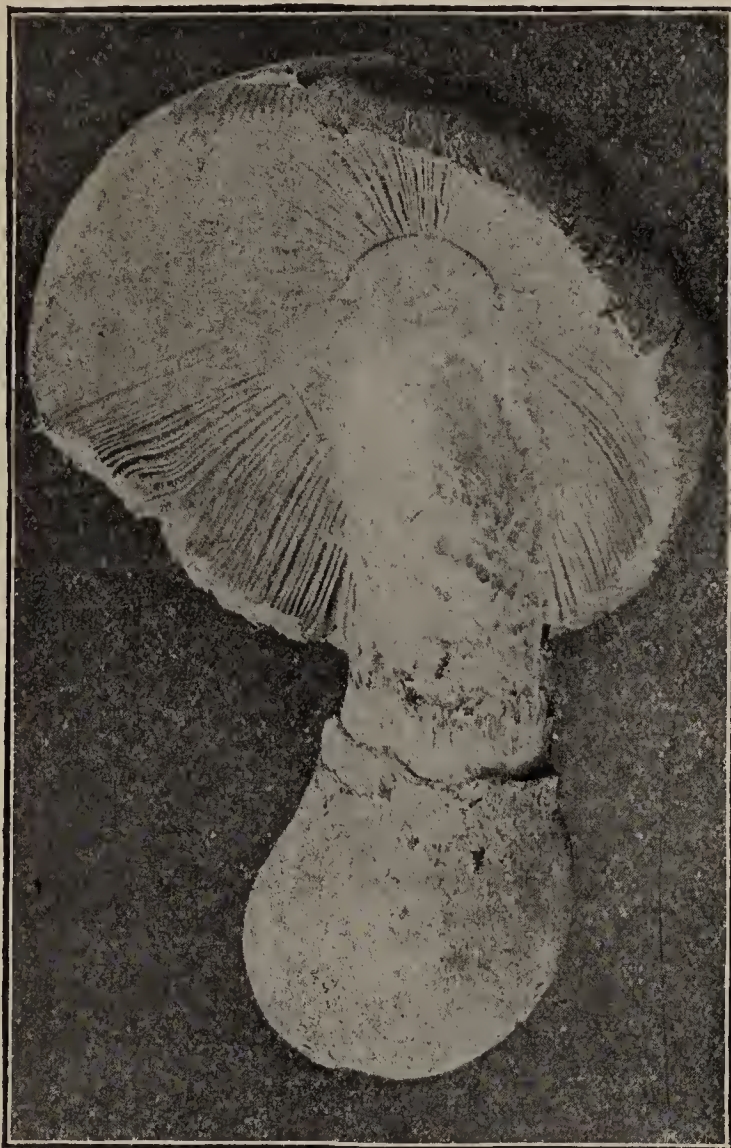


FIG. 24 —Fly amanita, *Amanita muscaria*, partly expanded. Poisonous. Three-fourths natural size.

Kamchatka from 1733 to 1743, namely, that the natives of the latter country, particularly the Koraks, used the fly amanita as an intoxicant, three or four specimens constituting a moderate dose for one habituated to its use, but ten being required for a thorough drunk. The same observations, with varied details, have been made by others, particularly by Langsdorff, who traveled around the world with the Russian navigator Krusenstern from 1803 to 1806, and in more recent times by Kennan in his first Siberian journey of 1865-67.

The plant may be taken fresh, but its taste is so disagreeable that only with great difficulty can a sufficient amount be eaten to produce

the intoxicating effect. The Koraks have two principal methods of taking it: First, by swallowing pieces of the dried caps without chewing them; second, by boiling the dry caps in water and then drinking the liquor thus produced mixed with the juice of berries or herbs to disguise the taste. The intensity of the poisonous character of the fly amanita undoubtedly varies at different ages, with different individuals, and with different methods of preparation. The amount of the poison that can be taken into the system with impunity varies, too, with the person who takes it. The fact that a

Korak, who has long used the plant as an intoxicant, can eat ten specimens and merely become drunk does not prove that a similar number would not be fatal to an American who had never eaten it before.

THE DEATH CUP (POISONOUS).

Amanita phalloides (Pers.) Fr.

Figs. 25 and 26 show one of the smaller forms of the death cup. The stem is set in a sort of white cup, the upper portion of which surrounds the base of the stem like a collar. This species resembles



FIG. 25.—Death cup, *Amanita phalloides*. Poisonous. Two-thirds natural size.

muscaria in its broad ring and in the white color of its stem, gills, and spores. The upper surface of the cap, however, is usually smooth and without corky particles, glossy, viscid, and of a white or slightly greenish, sometimes even yellow, color. Occasionally a few small and irregular patches are found on the top of the cap, as in fig. 27, consisting of fragments of the upper portion of the cup which became attached to the top of the mushroom when it was very young and just pushing itself out of the ground. The presence of

the cup which this species possesses, in common with others supposedly poisonous, is especially characteristic. It is usually situated well beneath the surface of the ground and should be carefully dug out when one is securing specimens for identification. Specimens occur, however, in which the inner surface of the cup is attached throughout to the stem, so that it presents the appearance, not of a cup, but of a mere bulbous base.

The death cup is a species not so abundant in the vicinity of Washington as the last, yet of rather frequent occurrence in rich oak woods. At Takoma Park it occurs in abundance. The lot that



FIG. 26.—Death cup, *Amanita phalloides*. Poisonous. One-half natural size.

caused the death of Chung Yu Ting in 1894 were gathered by him in the oak and hickory woods at Bethesda Park and identified by the microscopist of the Department of Agriculture as belonging to this species.

The poisonous principle of the death cup, according to the researches of Kobert, is of a totally different nature from that of the fly amanita. It is known as phallin and is one of the so-called toxalbumins, extremely virulent poisons found not only in plants but in rattlesnakes and some other poisonous animals. They are the substances that cause death in diphtheria, typhoid fever, Asiatic cholera, and various other diseases.

Mr. Chesnut has prepared the following account of the effect of phallin and its treatment:

The fundamental injury is not due, as in the case of muscarine, to a paralysis of the nerves controlling the action of the heart, but to a direct effect on the blood corpuscles. These are quickly dissolved by phallin, the blood serum escaping from the blood vessels into the alimentary canal, and the whole system being rapidly drained of its vitality. No bad taste warns the victim, nor do the preliminary symptoms begin until nine to fourteen hours after the poisonous mushrooms are eaten. There is then considerable abdominal pain and there may be cramps in the legs and other nervous phenomena, such as convulsions, and even lockjaw or other kinds of tetanic spasms. The pulse is weak; the abdominal pain is rapidly followed by nausea, vomiting, and extreme diarrhea, the intestinal discharges assuming the "rice-water" condition characteristic of cholera. The latter symptoms are persistently maintained, generally without loss of consciousness, until death ensues, which happens in from two to four days. There is no known antidote by which the effects of phallin can be counteracted. The undigested material, if not already vomited, should, however, be removed from the stomach and intestines by methods similar to those given for cases of poisoning by *Amanita muscaria*.

After that the remainder of the poison, if the amount of phallin already taken up by the system is not too large, may wear itself out on the blood and the patient may recover. It is suggested that this wearing-out process may be assisted by transfusing into the veins blood freshly taken from some warm-blooded animal. The depletion of the blood serum might be remedied by similar transfusions of salt and warm water.

Common table salt dissolved in water is a solvent of phallin, but, while it might be applied in removing the poison from the death cup before cooking, it is, unfortunately, impossible of application after the poison has taken effect.

It will be noted that both the species of poisonous mushrooms here described have white gills and white spores, and that all the edible gill-bearing species herein described, except *Coprinus comatus*,



FIG. 27.—Death cup, *Amanita phalloides*. Poisonous. One-half natural size.

have gills of some other color. In *Coprinus comatus* the spores at maturity are black. Several species of mushrooms having both white gills and white spores are edible, but a beginner might easily mistake an *Amanita* for them, and it would be well for him at the start to leave them entirely alone.

FREDERICK V. COVILLE,
Botanist.

Approved:
JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, May 15, 1899.

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